VARIABILITY IN THE NUMBER OF TEETH ON THE CLAWS OF ADULT SPIDERS, SHOWING THEIR UNRELIABILITY FOR SYSTEMATIC DESCRIPTION.[1]

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Since the number of teeth on the claws of spiders is often used as a specific character, the need of testing its constancy suggested itself. It has been pointed out by W. Wagner[2] that the number of ungual teeth varies with each moult. In the present study of the variations in the adult this fact was well taken into consideration, great care being exercised in choosing fully mature individuals that had undergone the last moult. To my knowledge no one has ever tested the constancy of the number in fully mature individuals.

The study was made on the claws of the right legs of 70 females and 40 males and comprises, therefore, observations on nearly 1,320 claws of 440 legs. Representatives of a number of different families were chosen as follows: Dictynidæ (*Dictyna volupis*, Keys., West Chester, Pa.), Theridiidæ (*Theridium tepidariorum*, Koch, Philadelphia), Pholcidæ (*Spermaphora* sp.? Hentz, Austin, Texas), Epeiridæ (*Epeira marmorea* Clerck; *E. benjamini*, Walck.; *Acrosoma reduvianum*, (Walck), West Chester, Pa.), Lycosidæ (*Lycosa nidicola*, Emerton, Austin, Tex.).

The counting of the claws was easy except in the case of *Dictyna volupis* and of *Spermophora;* but even here, if any mistakes in the counting are recorded, they are extremely few, for I never left a claw until convinced that my count was correct; or in a few cases where this seemed impossible the individual was entirely discarded. To count the teeth the three claws of each leg, if they were large, were snipped off with a needle (keeping the foot on a slide in a drop of alcohol) and pressed flat with a cover-glass. If the claws were too small, the whole tarsus was

[1] Contributions from the Zoölogy Department of the University of Texas, No. 55.

[2] W. Wagner, "La Mue des Aragnées," *Ann. Sc. Nat.*, 1888, p. 363.

TABLE I. FEMALES.

Species	No. of Leg.	No. of the Individual.									
		1	2	3	4	5	6	7	8	9	10
Dictyna volupis.	1	13,9 5	13,12 5	13,11 5	12,11 5	12,11 5	12,10 5	14,12 5	14,12 5	12,12 5	13,11 5
	2	12,10 5	———	12,12 5	12,10 5	11,— 5	12,12 4	12,12 5	12,11 5	13,13 5	11,12 5
	3	9,10 4	10,9 4	–,9 4	9,9 4	9,9 3	8,9 4	9,10 3	10,10 4	10,10 3	9,9 4
	4	9,10 4	9,10 4	10,10 4	9,10 4	9,10 3	9,9 4	11,10 4	9,10 4	10,11 4	10,10 4
Theridium tepidariorum.	1	6,6 2	6,5 2	5,8 2	6,5 2	6,5 2	6,6 2	4,5 4,5 2 2	6,5 –	6,5 2	6,6 2
	2	6,6 2	6,5 2	6,5 3,2	6,5 2	6,6 2	6,5 2	5,5 –,6 2 2	7,5 2	6,6 2	6,6 2
	3	5,6 2	5,6 2	5,5 2	5,6 2	5,6 2	5,6 2	–,5 –,6 2 2	5,6 2	5,6 2	6,6 1
	4	4,2 2	3,2 1	4,2 1	4,2 2	4,2 2	4,1 1	3,2 3,2 1 1	4,2 1	3,1 2	4,2 1
Sparmophora.	1	11,10 1	10,10 1	11,11 1	10,10 1	10,10 1	10,10 1	11,10 1	11,10 1	9,9 1	11,10 1
	2	10,10 1	10,10 1	11,10 1	———	12,10 1	10,10 1	11,10 1	11,11 1	9,9 1	10,10 1
	3	9,10 2	10,10 1	11,11 1	10,10 1	11,11 1	9,9 1	10,9 1	10,10 1	9,9 1	9,12 1
	4	7,9 0	7,9 1	–,9 2	9,10 1	7,9 1	8,10 1	8,10 1	8,9 1	7,8 1	10,10 1
Epeira marmorea.	1	7,8 2	8,8 2	7,8 2	8,9 2	9,7 2	7,8 3	7,8 3	8,8 2	8,8 3	9,9 3
	2	7,8 2	6,7 2	7,8 2	9,9 2	8,8 2	8,7 2	7,8 3	7,8 2	8,8 2	8,8 3
	3	6,6 2	–,7 2	———	6,7 2	7,6 2	6,5 2	6,6 2	6,7 1	6,6 2	8,7 2
	4	———	5,6 2	6,5 1	6,8 2	6,6 2	5,6 2	6,5 2	6,5 2	6,6 2	6,7 2
Lycosa nidicola.	1	4,4 0	4,4 0	4,4 0	4,4 0	4,4 0	5,4 0	5,4 0	4,5 0	4,4 0	4,4 0
	2	7,6 0	7,6 0	5,4 0	5,4 0	5,4 0	6,5 1	5,4 0	5,6 0	5,5 0	4,5 0
	3	———	7,6 0	6,6 0	7,6 0	6,5 0	7,7 0	7,6 0	7,7 0	7,7 0	6,6 0
	4	6,5 0	9,9 0	6,7 0	6,7 0	5,7 0	8,8 0	7,7 0	8,8 0	7,7 0	7,7 0
Epeira benjamini.	1	5,8 2	5,9 2	8,– 3	8,8 2	9,8 3	8,8 2	10,8 3	8,9 2	7,8 2	6,8 2
	2	5,9 2	6,9 2	5,6 3	7,9 2	7,9 3	8,8 2	8,9 2	7,8 2	6,8 2	7,8 2
	3	3,6 2	8,7 2	7,6 2	7,7 2	8,7 2	7,7 2	6,11 2	7,6 2	7,7 2	6,6 2
	4	6,5 2	7,6 2	7,6 2	4,5 2	6,5 2	5,5 1	6,5 2	6,5 2	6,5 2	6,5 2

TABLE I. FEMALES.—*Continued.*

Species	No. of Leg.	No. of Individuals.									
		1	2	3	4	5	6	7	8	9	10
Acrosoma rediviuum.	1	7,6 / 2	7,6 / 2	7,7 / 2	7,6 / 2	7,7 / 2	7,6 / 2	8,7 / 2	7,6 / 2	7,7 / 2	7,7 / 2
	2	———	7,6 / 2	7,6 / 2	7,6 / 2	7,– / 2	6,6 / 2	6,7 / 2	7,7 / 2	7,7 / 2	6,7 / 2
	3	5,6 / 2	5,5 / 2	6,5 / 2	6,5 / 2	6,6 / 2	5,5 / 2	6,6 / 2	5,5 / 2	6,6 / 2	5,5 / 2
	4	3,2 / 1	3,4 / 2	3,4 / 2	4,4 / 2	———	4,5 / 2	5,4 / 2	4,2 / 1	4,4 / 2	4,3 / 1

covered, placed under the compound microscope and pressure applied until all the teeth came into full view.

The results of the counting of the teeth are recorded in the accompanying tables, Table I. containing the figures for the females and Table II. for the males. The three claws were always distinguished from one another and the number of teeth on each recorded after the formula $\frac{a, p}{i}$, where a represents the number of teeth on the anterior, p on the posterior and i on the inferior claw.

The reduction in the number of teeth seems to take place at the proximal end of the claw because, firstly, the distal teeth usually maintain the size and form characteristic of the species, and secondly because the proximal tooth (or teeth) in some cases becomes so small as to merit the name tubercle in place of tooth. This latter fact forced me to establish a criterion to determine what to count as a tooth and I decided to call the structure a tooth if it had attained a length at least half as great as its width at the base. In *Dictyna volupis* the two distal teeth are small and are closely approximated to the claw for nearly their entire length. One of these was counted in some four or five cases where it was unusually large and stood out from the claw for at least half its length.

In order to reduce the tables to percentages so as to get at a simple set of figures for comparison I have adopted what may be called the "percentage of constancy" method, which may be illustrated as follows:

In Table I. the anterior claw of the first leg of *Lycosa nidicola*

TABLE II. MALES.

Species	No. of Leg.	No of the Individual. 1	2	3	4	5	6	7	8	9	10
Dictyna volupis	1	12,11 5	12,11 5	12,10 5	12,11 5	12,9 5	11,11 5	11,11 5	10,10 4	11,11 7	11,10 6
	2	12,12 6	12,11 5	13,12 5	11,11 5	12,11 5	12,11 5	11,– 5	11,11 5	12,11 6	11,10 6
	3	11,11 4	11,10 4	9,9 4	9,10 4	9,9 4	9,9 4	10,10 5	9,9 4	–,10 4	10,10 5
	4	11,11 5	10,10 4	9,9 4	10,10 4	10,9 4	10,10 4	11,10 4	9,10 4	10,11 5	10,10 5
Theridium tepidariorum	1	4,4 1	5,5 1	5,4 2	5,5 2	6,4 2	–,4 2	5,– 2	5,5 2	5,5 2	5,5 2
	2	4,4 1	5,4 2	5,4 2	5,4 2	5,4 2	5,4 2	5,4 1	5,5 2	5,5 2	5,5 2
	3	–,4 1	4,5 2	5,3 2	4,5 2	3,5 2	4,3 2	4,5 2	4,3 2	4,4 2	5,5 2
	4	2,1 1	3,1 1	3,1 1	3,1 1	4,1 1	3,– 1	4,1 1	4,1 1	3,1 1	4,1 1
Spermophora	1	12,11 1	12,– 1	12,11 1	12,10 1	11,10 1	10,9 1	10,10 1	11,10 1	11,10 1	12,11 1
	2	12,10 1	11,10 1	12,11 1	11,10 1	12,11 1	10,9 1	11,10 1	10,10 1	11,10 1	11,10 1
	3	10,11 1	11,11 1	11,10 1	–,10 1	11,11 1	9,9 1	10,10 1	9,9 1	10,9 1	10,10 1
	4	9,10 1	8,10 1	8,10 1	8,10 1	9,10 1	8,9 1	8,9 1	8,9 1	___	9,10 1
Epeira marmorea	1	7,9 2	10,11 2	9,8 2	8,9 2	8,9 2					
	2	8,8 2	7,9 2	8,8 2	8,8 2	___					
	3	6,6 2	6,6 2	7,8 2	6,6 2	6,6 1					
	4	6,6 2	7,– 2	–,5 1	6,5 1	6,6 1					
Lycosa nidicola	1	6,6 0	6,6 0	6,6 0	6,7 0	6,6 0					
	2	7,7 0	8,8 0	7,7 0	7,8 0	7,8 0					
	3	8,9	9,10 1	8,8 0	8,8 0	9,9 0					
	4	8,9 0 0	9,9 0	___	9,9 0	10,10 0					

has 4 teeth 8 times out of 10, the posterior claw has 4 teeth 9 times out of 10. So that the claws have percentages of constancy of 80 and 90 respectively. On the second leg of the same species the anterior claw has 5 teeth more often than any other number of teeth or in other words it has a maximum constancy of

5 in 10 = 50 per cent.; the posterior claw has a maximum constancy of 40 per cent. having 4 teeth 4 times in 10. This method was pursued throughout. Where only five specimens of a species were examined the result was calculated to ten. On the basis of these data the following conclusions were drawn. Where percentages are cited they are percentages of constancy and refer only to the superior claws.

1. Claws having larger numbers of teeth show more variation in numbers than claws having a smaller number and this holds for both sexes. The percentages of constancy for the superior claws of male and female are as follows : *Spermophora* 52 per cent., *Dictyna volupis* 54 per cent., *Epeira marmorea* 59.5 per cent., *Lycosa nidicola* 62 per cent., *Theridium tepidariorum* 68 per cent. A glance at the tables will convince one that this order will practically hold for the relative total number of teeth.

The same result is more strikingly shown by the inferior teeth. In *Dictyna volupis*, which has normally 4–5 teeth on the inferior claw, there are 16 variations in 80 cases of both males and females ; while *Spermophora* and *Lycosa nidicola*, which have normally only 1 and 0 tooth respectively have only 3 variations in 80 cases in the former case and 1 in 60 in the latter.

Moreover, the superior claws, having many teeth, show many times as much variation as the few-toothed inferior claw.

2. The teeth on the claws of the first leg show least variation in number, those on the third most. The percentages of constancy are : First leg, 61.5 per cent.; second leg, 60.0 per cent.; third leg, 57.0 per cent.; fourth leg, 58 per cent.

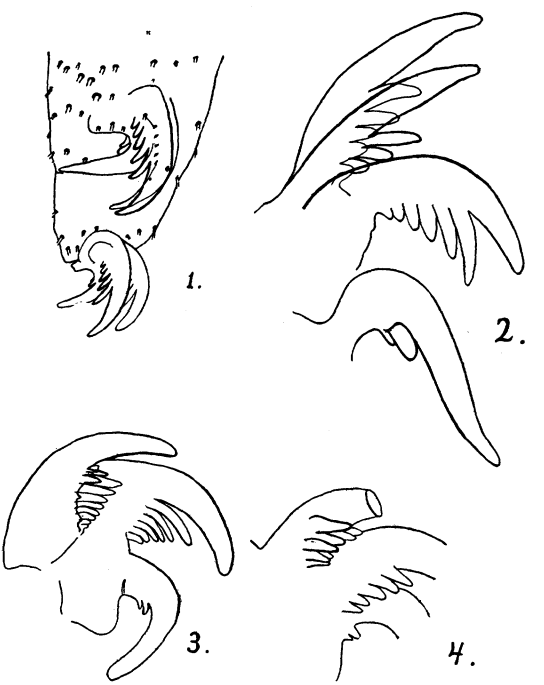
3. The number of teeth on the claws of the female varies slightly more than in the male, the percentages of constancy being 58.0 and 59.75 respectively. The inferior claw gives the opposite result, however, for here in the females there are 17, in the males 19 deviations from the normal in 160 cases. A glance at the tables will disclose a sexual dimorphism in the total number of teeth which may be greater in the male or in the female or the same in both, according to the species. Thus by actual count 5 females of *Epeira marmorea* have 318, 5 males 335 ungual teeth on the right side ; but 5 females of *Lycosa nidicola* have 318 teeth as against 228 for 5 males; while 10 females and 10 males of *Dictyna volupis* have each 1,030 teeth exactly.

4. The anterior and the posterior claws vary in nearly equal measure throughout, the average constancy percentage for the former being 58.0, for the latter 59.75.

5. In only one case were two individuals found that had the same number of teeth on the corresponding claws of all the four legs on the right side (Table II., *Theridium tepidariorum*, individuals 2 and 4).

In view of these facts one would be safe in saying that the number of teeth on the tarsal claws of spiders is too variable to be used as a specific character; it should at least not be used in a diagnosis until its absolute constancy for a given species has first been demonstrated.

In addition to this common variation in the number of teeth on the claws one often meets with additional claws or with double



rows of teeth on the same claw (mutations). Fig. 1 represents the first foot of the seventh specimen of *Theridium tepidariorum* in Table I. Two complete sets of claws, similar to the ones

figured for the first leg, were found on each leg of the animal, both on the right and on the left side. These claws were all of the normal type but possessed relatively fewer teeth than those on the claws of other specimens of the same species.

Fig. 2 represents four claws on the second leg of the second female of *Theridium tepidariorum*, the claw bearing three teeth being an additional inferior one.

Figs. 3 and 4 show on the posterior claws double rows of teeth, the additional row lying close to the normal and more regular one. The claws in Fig. 3 are from the third leg of specimen seven of *Epeira benjamini* and those in Fig. 4 from the fourth leg of specimen four of *E. marmorea*, both in Table I.

In conclusion I wish to thank Dr. T. H. Montgomery for the many specimens which he placed at my disposal and for his kind suggestions in my work.

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